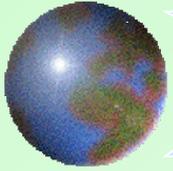




# Present Status of EPICS Development at the 3GeV Proton Beam Transport Facility Control System in J-PARC

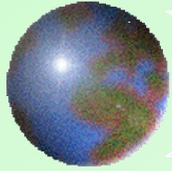
JAERI

Motoki Oi      Tetuya Kai      Sinichiro Meigo  
Sinichi Sakai   Hidetaka Kinoshita      Kenji Sakai  
Masanori Kaminaga



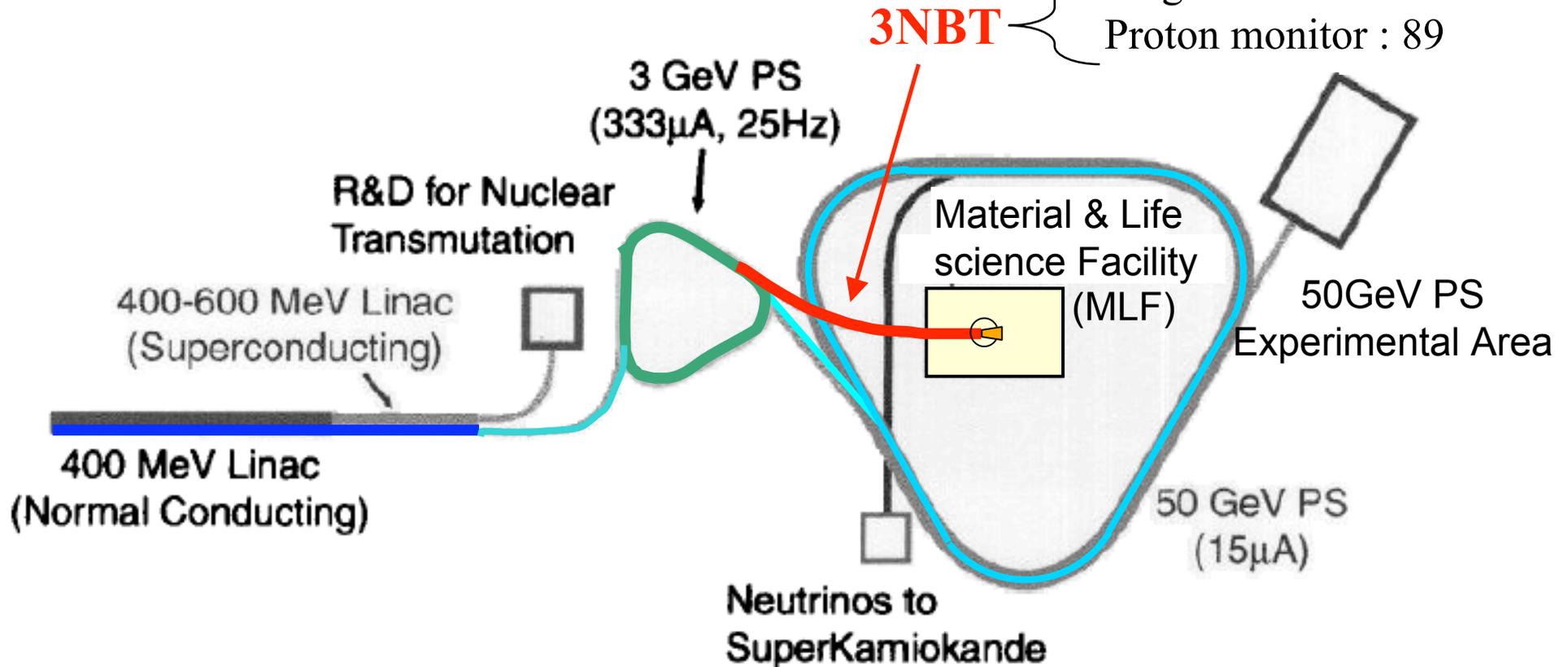
# *Contents*

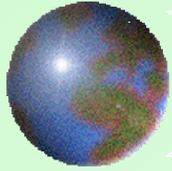
- Outline of 3NBT monitor system
- Goal of 3NBT EPICS system
- About CC/NET
- Data Read & archive performance test
- Channel access data missing and Tick frequency
- Profile monitor test in KEK
- Summary



# 3 GeV Proton Beam Transport Facility (3NBT)

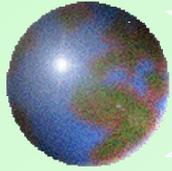
Beam loss :  $\sim 1\text{W/m}$   
Length : 310m  
Magnet : 108  
Proton monitor : 89



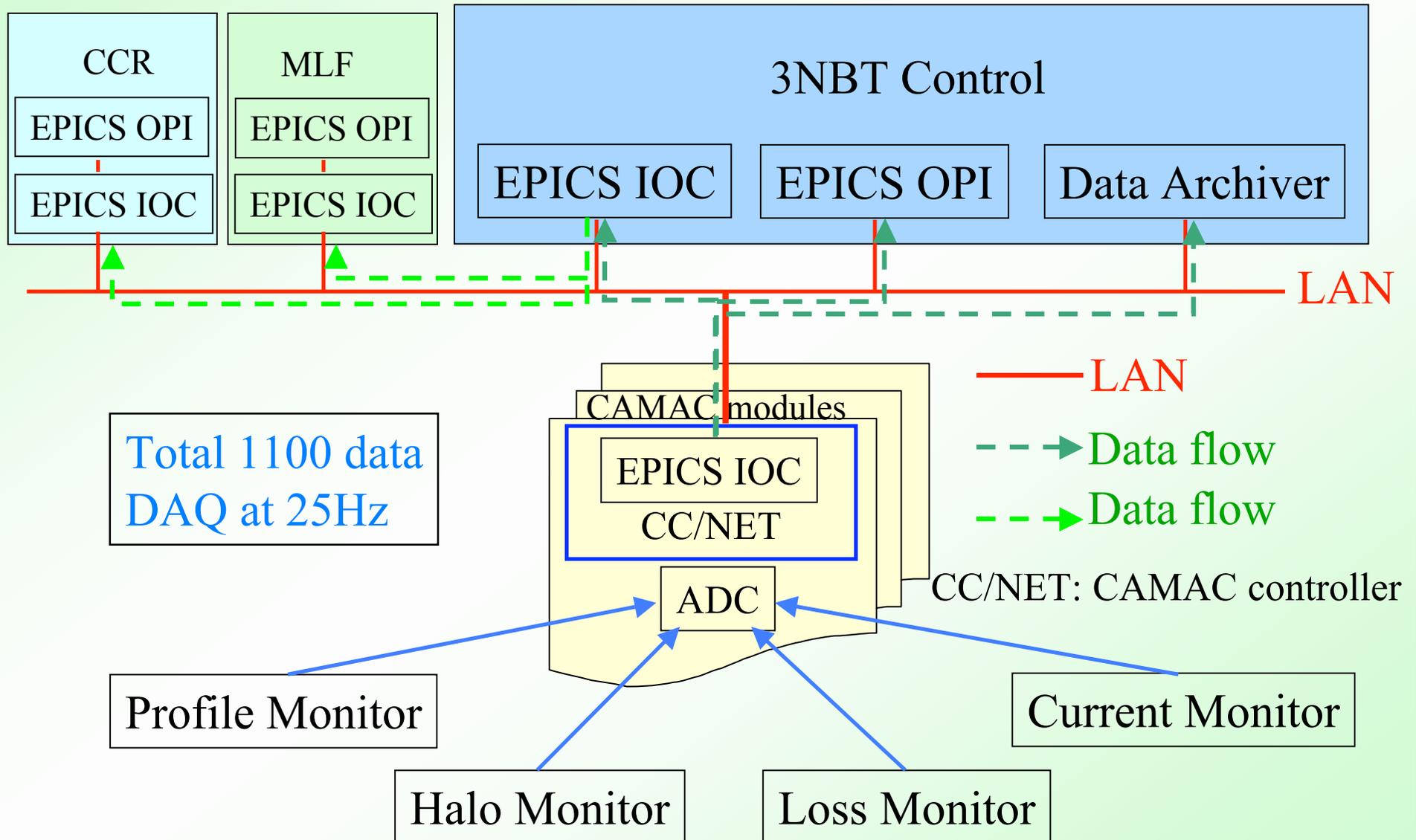


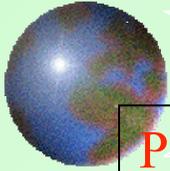
## *Goal of 3NBT EPICS system*

- Monitor all of the proton beam monitors at 25Hz
- Archive all of proton beam monitor data with data tag
- Control and monitor the beam line components  
(Magnet power supply, vacuum, etc.)
- Joint 3NBT to CCR and MLF control with EPICS network



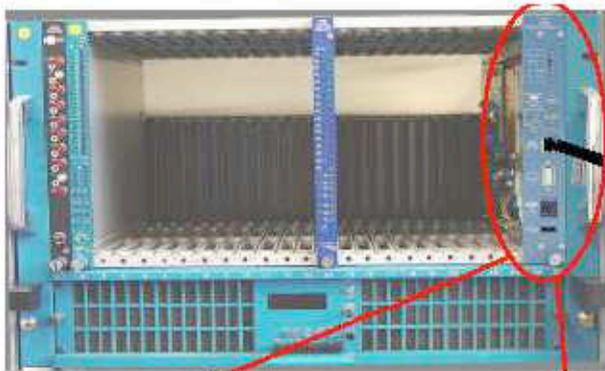
# Outline of 3NBT Monitor system





# What is CC/NET

PC104Plus Single Board Computer  
 Interface: PCI and CAMAC  
 CPU: Crusoe 500MHz  
 Memory : 310MB  
 Main Drive: Compact Flash 1GB  
 Network : 100Mbps Ethernet  
 OS : 2.4 kernel Linux

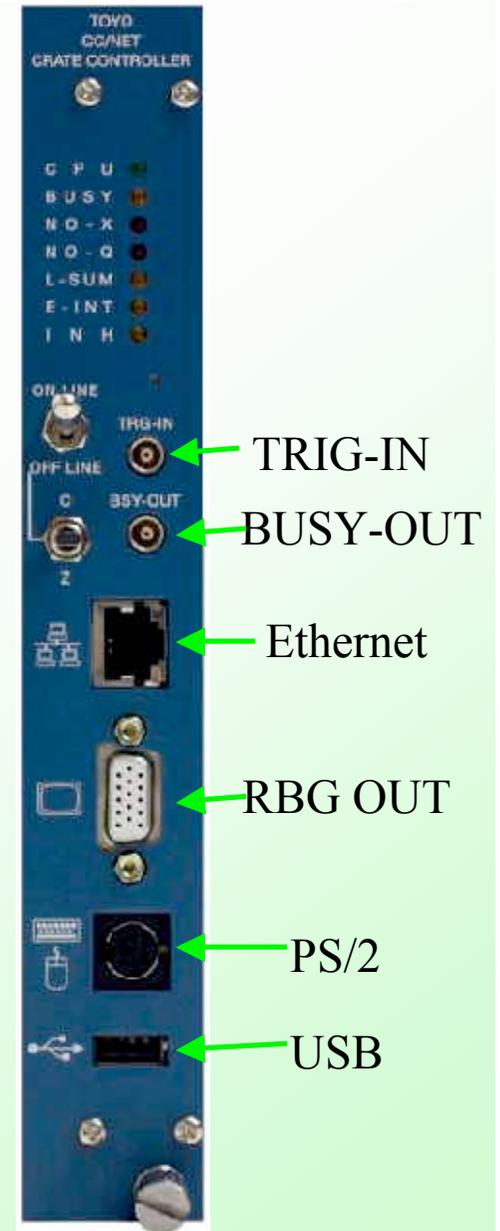


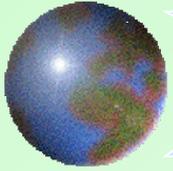
Fast Ethernet



PC104plus PC board computer  
 PCM-9370's Crusoe TM5400,  
 Memory, Flash Disk, Ethernet,  
 USB, ...

ALTERA FPGA for PCI  
 ALTERA FPGA for CAMAC



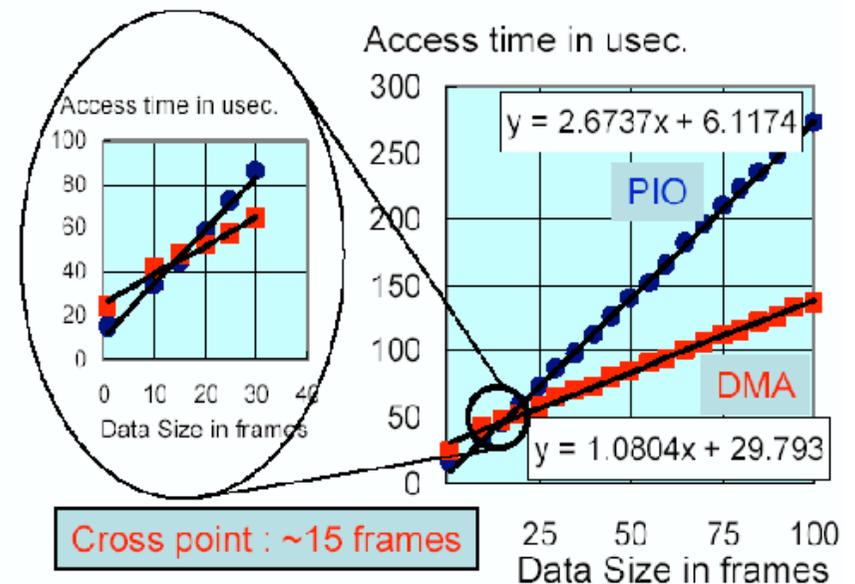


# DAQ mode of CC/NET

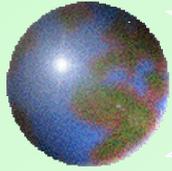
CC/NET have three DAQ mode

	Single mode	Programmed I/O mode	Dynamic Memory Access mode
Over head	Small	Small	Large
DAQ Speed	Low	Middle	Fast
CPU load	High	Low	Middle

Pipeline method used in PIO and DMA mode



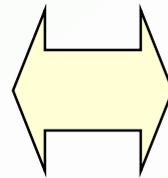




# *Data Taking*

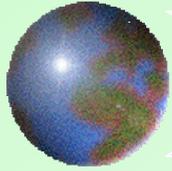
16ch ADC x 23 slot = 368 data / CAMAC module  
368 data / waveform is not reasonable.

64 data / Profile monitor  
4 data / Halo monitor  
4 data / Loss monitor

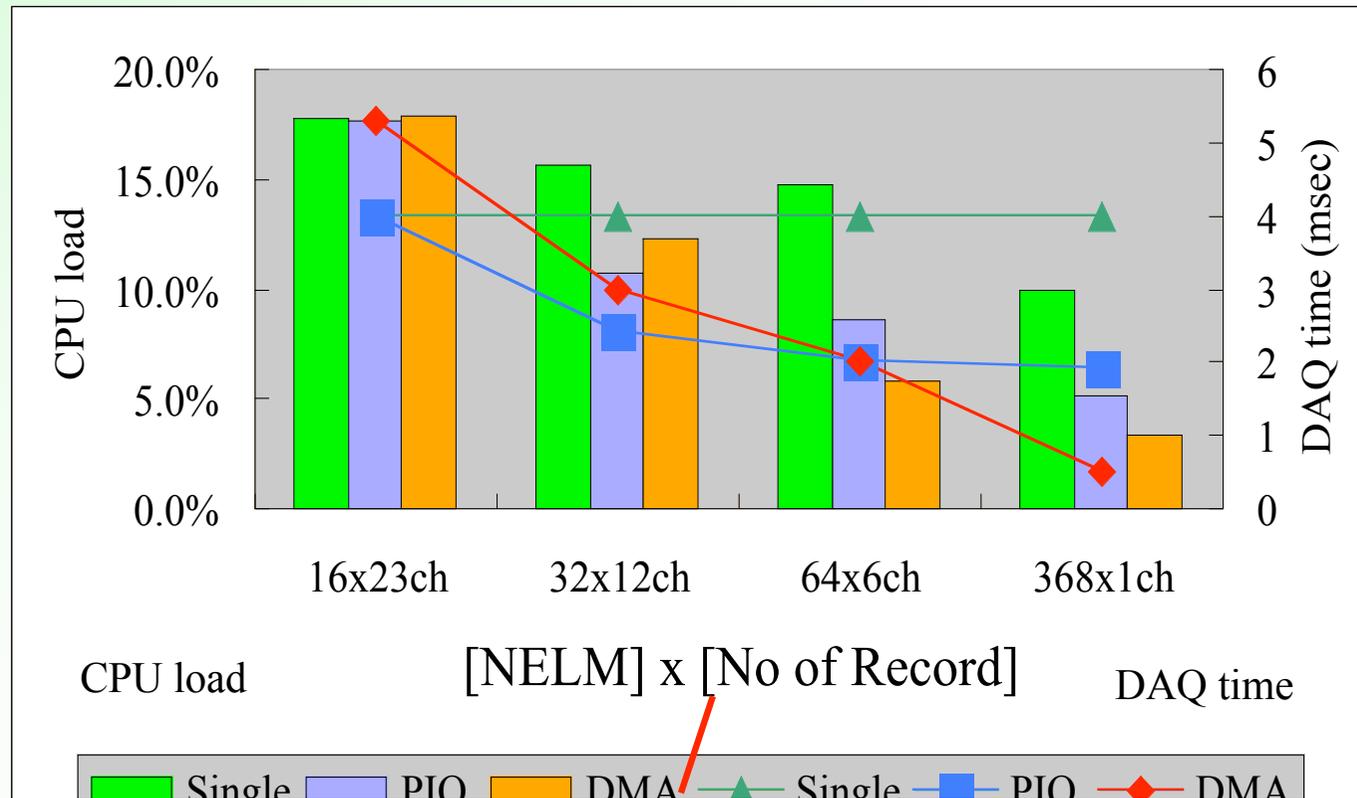


**64 data is reasonable**

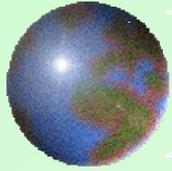
Change the NELM / Record and examine CC/NET-EPICS  
DAQ performance test



# Data Read & Archive performance test @25Hz



For small Number of Element, PIO mode is the better



# Data missing in Channel Access

In the channel access between EPICS IOC to EPICS IOC, we got data missing.

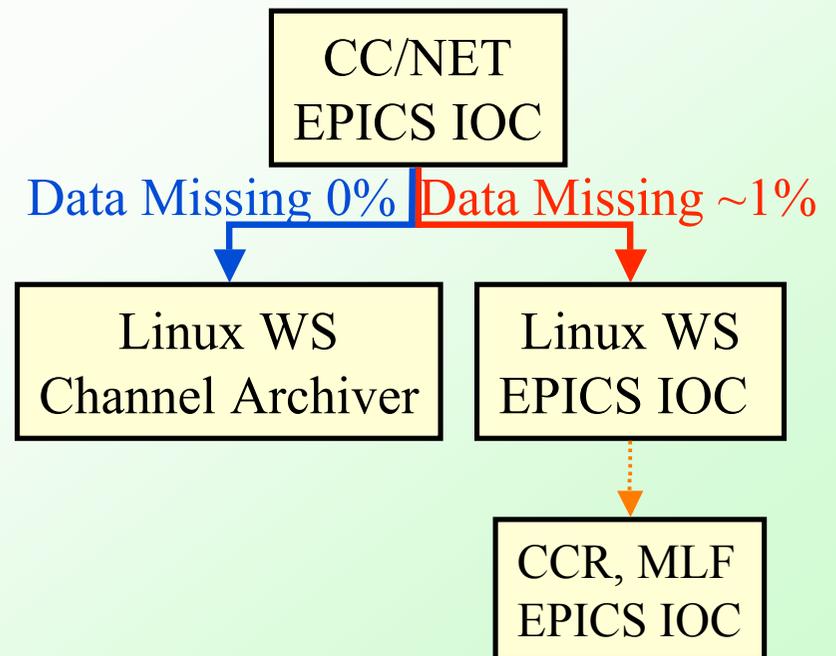
As a cause of data missing, I expect Linux tick frequency.

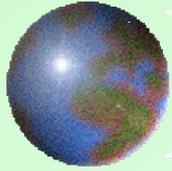
Default tick frequency is 100 Hz.

DAQ frequency is 25 Hz.

These are near in order.

Change Linux tick 1000 Hz  
Compare Data missing ratio





# *Tick and DAQ frequency*

Channel Access Data missing CC/NET to Linux IOC

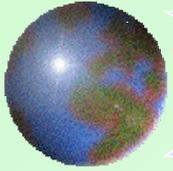
DAQ Tick (Hz)	100Hz	1000Hz
1Hz	0.1%	0.1%
10Hz	0.2%	0.2%
<b>25Hz</b>	<b>0.8%</b>	<b>0.2%</b>
33Hz	0.7%	0.2%
50Hz	0.6%	0.2%

PIO mode

Waveform 368 element

CA performance is a little bit improved.

This CA result is not perfect but enough  
for monitoring with I/O display

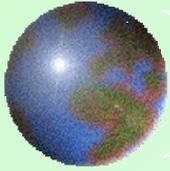


# *Profile Monitor Test in KEK*

3NBT line transports 1 MW power proton beam, we have to develop long life profile monitor.

SiC wire type profile monitor is developed.

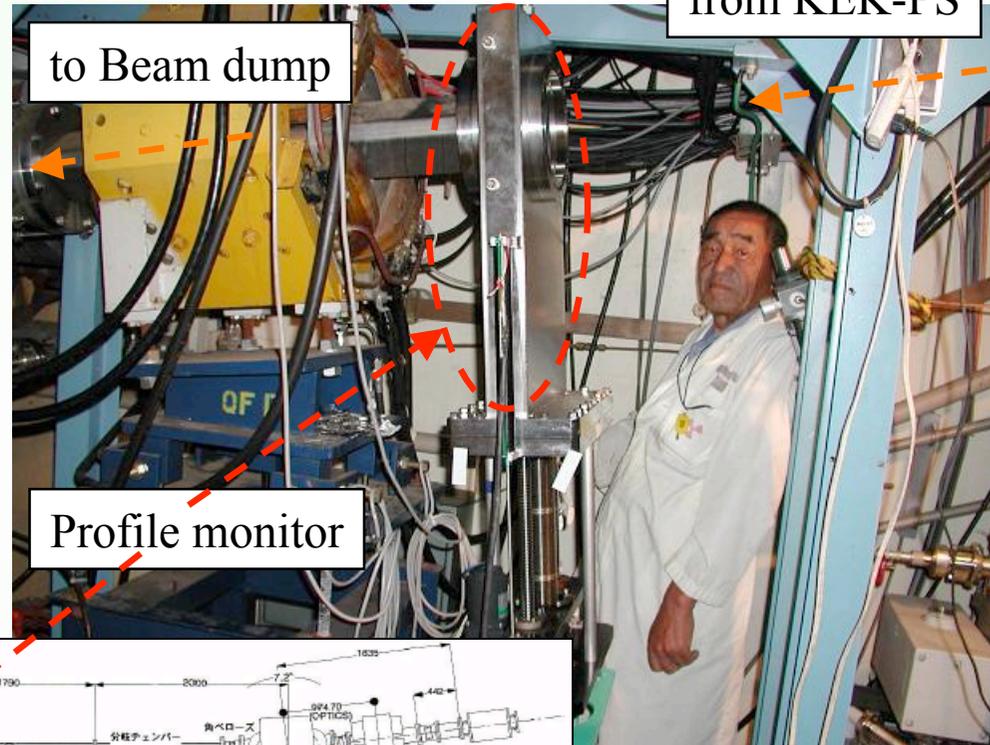
Profile monitor performance is tested in KEK proton beam dump line.



# KEK NML Beam Dump

Proton Energy : 500 MeV  
Proton current :  $182 \times 10^{10}$  ppb  
Frequency : 0.45 Hz  
Beam port : Beam dump line

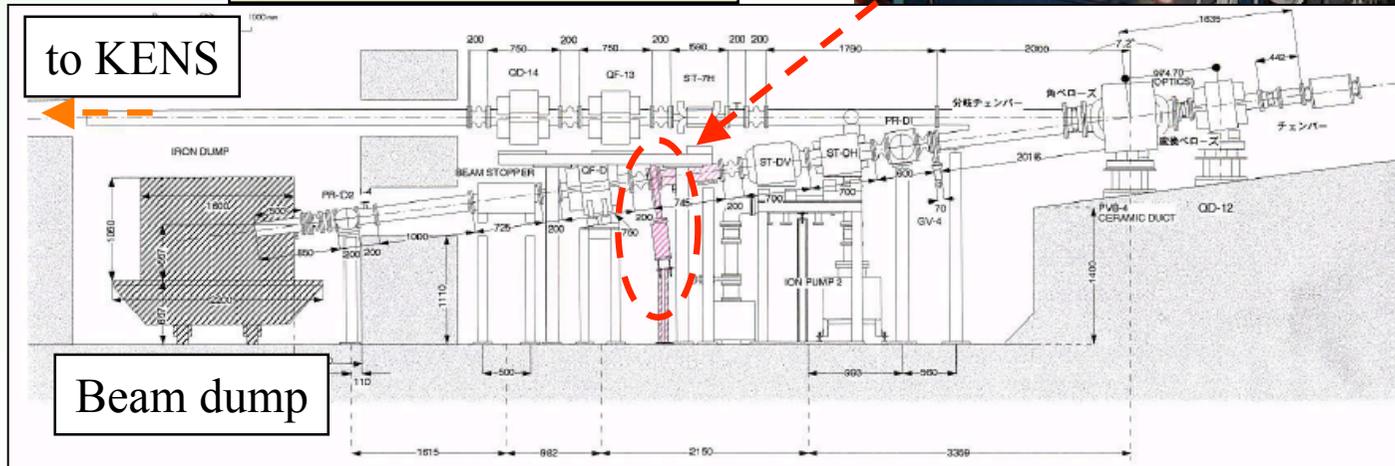
from KEK-PS



to Beam dump

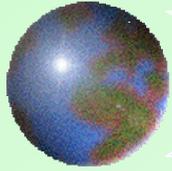
Profile monitor

NML Beam dump



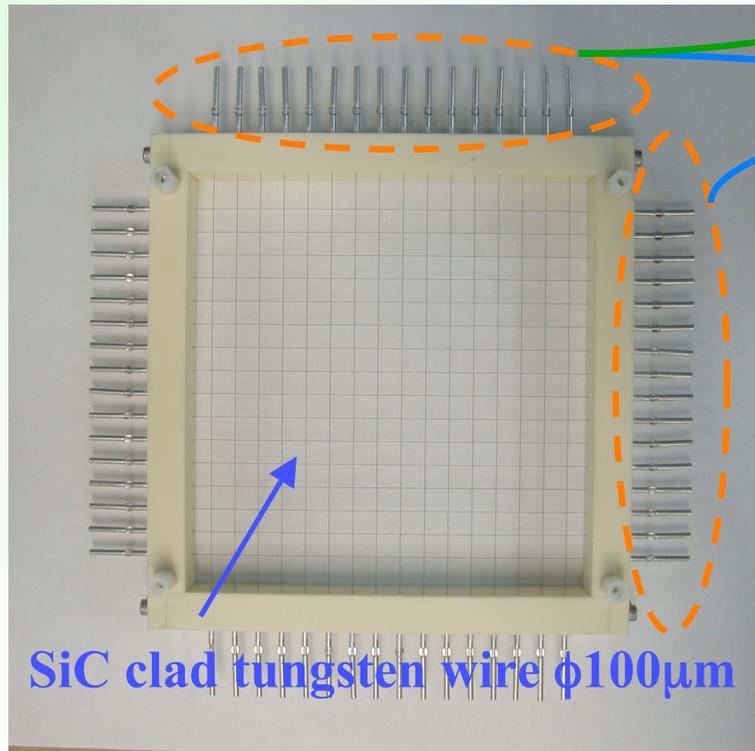
to KENS

Beam dump

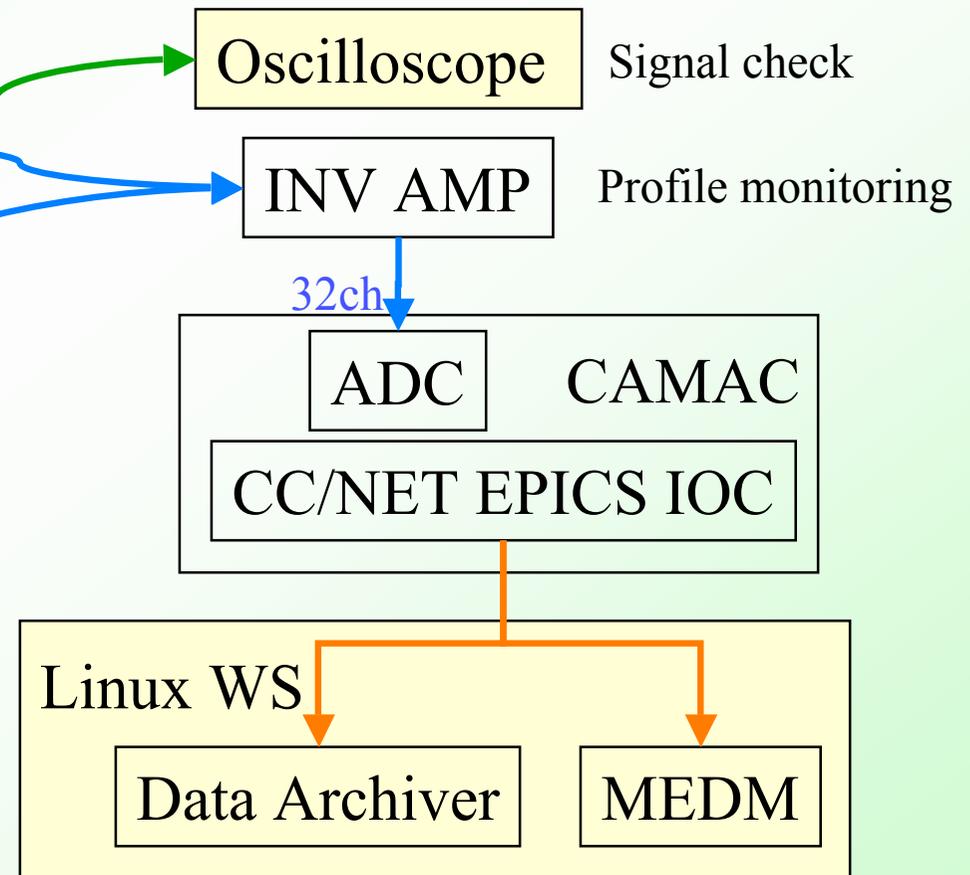


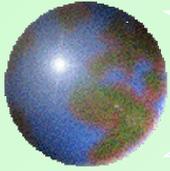
# Profile monitor test component

Prototype profile monitor



H:16 V:16 wires

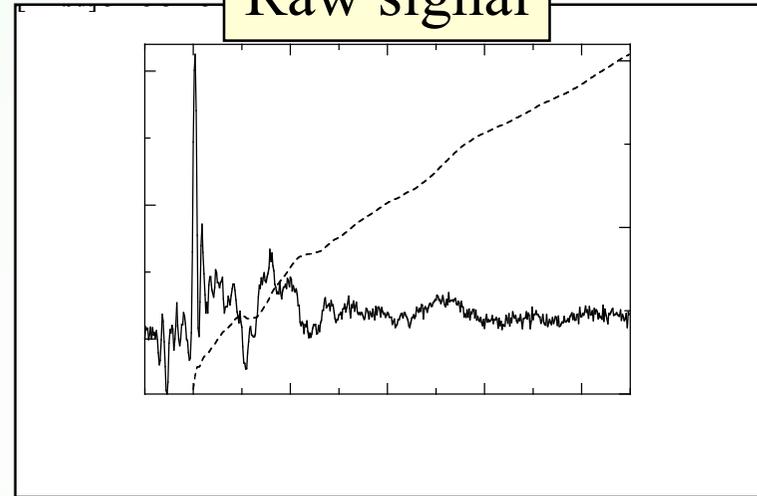




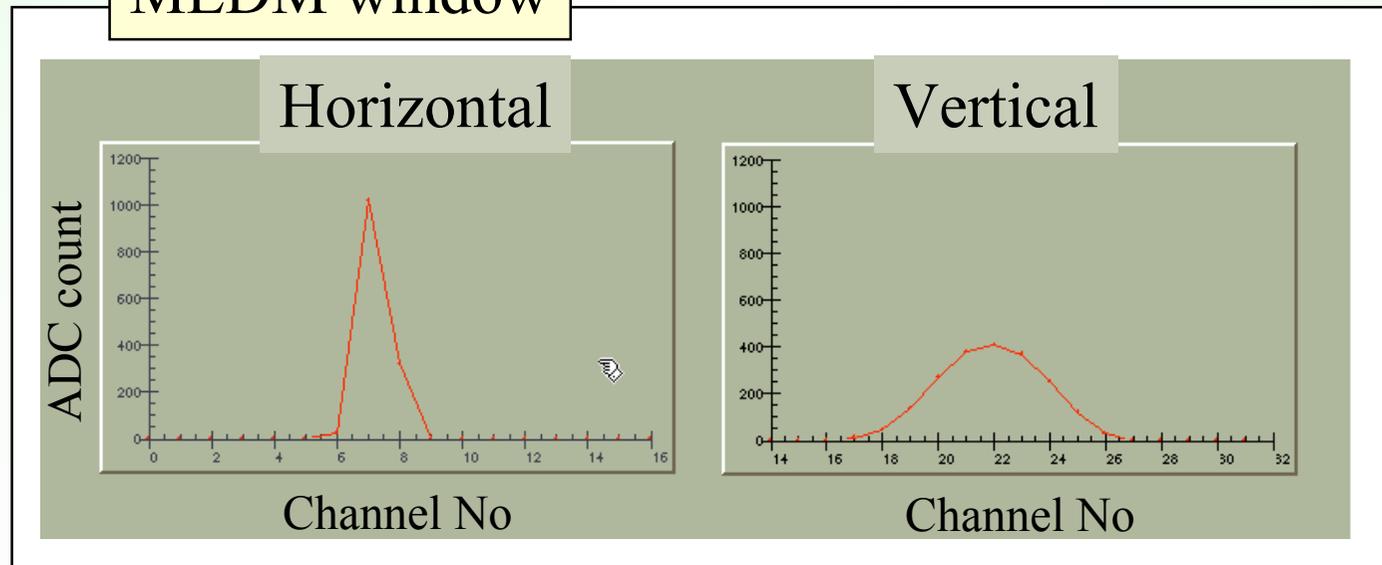
# Results

Successfully get proton beam profile with SiC wire profile monitor!!

Raw signal



MEDM window

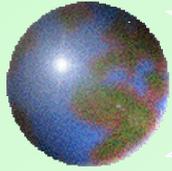


x32ch

Inv AMP

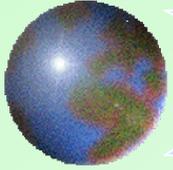
ADC

EPICS IOC



# Summary

- EPICS for 3NBT control system is under construction
  - Data archive at 25Hz from CAMAC-CC/NET to Channel archiver on Linux WS is successful, but data transport among EPICS IOC has still data missing.
    - 25Hz DAQ data taking becomes better with changing the linux tick to 1000Hz.
- SiC wire proton beam profile monitor test was succeeded.



## *Future plan*

- Improve the EPICS data missing problem.
- PLC (FA-M3) data I/O operation test.
- Design 3NBT OPI display.
- Design and test the DAQ and data archive system with full scale system.